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ELECTRICAL SWITCHING DEVICE

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[Electrische Schalteinrichtung]

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Documents consulted in the examination process according to § 44 of the Patent Law:

DE 41 19 316 C1
DE 33 37 122 C2
DE 41 23 480 A1
DE 33 33 497 A1

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Description

The present invention starts from an electrical switching device, conceived according to the preamble of the main claim.

Such devices, especially those utilizing the Hall effect, are provided to precisely engage and disengage an electrical circuit with the least possible switching hysteresis. Such switching devices are prescribed, for example, for a wide variety of functional areas in vehicles and are then used, for example, as brake light switches, gearshifts, etc.

An electrical switching device became known with DE 33 33 497 A1, in which two permanent magnetic components are arranged in a multipart housing, whose poles, having the same polarization, are opposite each other with a spacing. A Hall effect switching component is

arranged between the poles of the two permanent magnetic components. The first permanent magnetic component is attached to the operating device of the switching device, and the second permanent magnetic component is secured adjustable in the housing. The distance between the second permanent magnetic component and the Hall effect switching component is adjusted in this electrical switching device by an adjustment device, in which the second permanent magnet is fastened directly to the adjustment device. In an object designed in this way, both the two permanent magnetic components and the Hall effect switching component, as well as the mounting device provided for them, are exposed to the environmental conditions prevailing in the housing. During aggressive environmental effects, it can therefore happen that especially the Hall effect switching component, as well as the corresponding mounting device, are adversely affected in their functional capability. This can ultimately lead to failure of the electrical switching device.

An electrical switching device also became known from DE 33 37 122 C2, which consists of a longitudinally adjustable operating device, designed as a pushbutton, held in a housing top, as well as a moving switching element, formed from a so-called switching mat, arranged in a housing bottom, and a non-moving switching element, arranged on an insulation plate secured on the housing bottom. The switching elements are then formed from different electrode layers. By dividing the housing into a housing top and a housing bottom, and by arranging the switching mat and the operating device, spatial separation of the operating device and the switching elements is produced.

A switching device corresponding to the preamble of the main claim also became known from DE 41 19 316 C1, in which two housing chambers, hermetically separated from each other, formed by a partition, are present in a multipart housing. A permanent magnetic component is then connected to the operating device arranged in one housing chamber, whereas a Hall effect switching component that can be influenced by the permanent magnetic component is provided in the other housing chamber. The permanent magnetic component and the switching component are then connected to both sides of the partition in an opposite arrangement.

Finally, an electrical switching device, having a housing consisting essentially of a housing bottom and a housing top, became known from DE 41 23 480 A1. An operating device, designed like a plunger, is arranged centrally in the housing top and mounted movable against the force of a readjusting spring, and is designed as a hollow cylinder and is ferromagnetic on the end situated in the housing. The free end of a guide pin, fastened on the bottom of the housing bottom with its other end, is connected to the hollow, cylindrical end of the operating device situated in the housing, also arranged centrally and engaging in the internal region of the housing. The guide pin is then provided with a centrally running channel-like recess, starting from the bottom of the housing, in which a rod-like permanent magnet is arranged, so that it is

surrounded in the end position of the operating device by the hollow, cylindrical end of it and is not enclosed by it in the other end position.

On the other hand, a Hall effect switching component is connected in the hollow, cylindrical end of the operating device in a manner almost tangential in its outer region, which is arranged on a circuit board extending parallel to the longitudinal axis of the operating device, and also secured on the bottom of the housing bottom, so that it is roughly as far from the bottom of the housing as the permanent magnet is. Owing to the fact that the hollow, cylindrical, ferromagnetic end of the operating device influences the trend of the lines of force of the permanent magnet during its movement, the switching state of the Hall effect switching component is altered.

In all of the variants just mentioned, there is the problem that only one electrical switching function (on/off) can be accomplished with them.

The underlying task of the present invention is therefore to modify an electrical switching device of the type just mentioned, so that several switching functions connectable to each other can be implemented.

This task is solved by the features stated in the characterizing part of the main claim.

This type of electrical switching device is particularly advantageous in that it has relatively few mechanically operated components. This type of product is therefore particularly low in wear, so that high numbers of position changes can reliably be achieved with it.
Other particularly favorable embodiments of the object according to the invention are stated in the dependent claims and are further explained by means of the practical example depicted in the figures. In the figures

Fig. 1 shows an electrical switching device in a longitudinal section along A-A of Fig. 2,

Fig. 2 shows the electrical switching device according to Fig. 1 in a longitudinal section along line B-B of Fig. 3,

Fig. 3 shows the electrical switching device according to Fig. 1 and 2 in a cross section along line C-C of Fig. 2.

As follows from the figures, an electrical switching device has an essentially rotationally symmetric multipart housing 1, consisting of a housing top 1a and a housing bottom 1b. Two operating devices $3a_1$, $3a_2$ are arranged in the housing top 1a in the two housing chambers $2a_1$, $2a_2$ present there. These are each supported with one end region $3a_1$", $3a_2$" via a spring element $4a_1$, $4a_2$, designed as a coil compression spring, on the corresponding chamber bottom, whereas they protrude with their other (free) end region $3a_1$', $3a_2$' from the corresponding housing chamber $2a_1$, $2a_2$ on the side of the housing top 1a facing away from housing bottom 1b. In order for the operating device that can be influenced by a cam-like control device not to fall out from the corresponding housing chamber, a mounting element 6 is arranged in it that partially closes

the housing chambers, so that only the offset free end regions of the operating device protrude from the corresponding housing chamber, whereas the other end regions of the operating devices situated in each housing chamber are supported via a shoulder-like extension $3a_1$**, $3a_2$** on the mounting element, because of the force supplied by each corresponding spring element.

On the outermost end of the end region $3a_1$', $3a_2$' protruding from the housing chambers $2a_1$, $2a_2$ of each of the two operating devices, a roller-like adjustment element $5a_1$, $5a_2$ is mounted, in order to permit perfect operation of the operating devices $3a_1$, $3a_2$ by the corresponding cam-like control device.

In the region of the end region lying in each housing chamber $2a_1$, $2a_2$ of the operating device, having an essentially rectangular cross section, a permanent magnetic component $7a_1$, $7a_2$ is inserted on a long side of the operating device, so that it is arranged with its magnetic action element (magnetic pole surface) parallel to the partition $1c_1$, $1c_2$ and at a minimal distance from one side $1c_1$', $1c_2$'.

On the other side $1c_1$", $1c_2$" of the partition in a housing chamber 2b, formed by joining the housing top and housing bottom, two switching components $8a_1$', $8a_1$"; $8a_2$', $8a_2$" that preferably utilize the Hall effect and can be influenced by the permanent magnetic component $7a_1$, $7a_2$ present on the two operating devices $3a_1$, $3a_2$ are arranged. These are arranged in pairs in the movement direction of each of the two operating devices, one behind the other, and therefore come into the region of influence of the corresponding permanent magnetic component during movement of each operating device.

The two switching components allocated to one operating device are fastened on a circuit board 9, optionally equipped with electronic components, which is secured in opposite guide grooves $1e_1$, $1e_2$, which are provided on housing wall sections $1d_1$, $1d_2$ formed on the housing top 1a present in housing chamber 2b. The conductor tracks electrically connected to the switching components present on the circuit board are connected to terminals 10*, which are present on contact parts 10, whose other ends 10** are designed as outward guided plug contact elements surrounded by a housing collar 1f.

Since this type of switching device can find use as a so-called gearshift, the housing 1, on the one side, must be configured so that no oil situated in the gears can penetrate into the second housing chamber 2b, i.e., into the interior space equipped with the electrical components. For this purpose, between the hollow cylindrical regions of the housing top 1a and the housing bottom 1b cooperating with each other, a continuous annular sealing device 11 is arranged. Another sealing device 12, present on the housing top, prevents oil from coming out from the interior of the gear above the transmission from the outer wall of the housing top 1a penetrating the inner wall of the opening provided to accommodate the housing.

The function of the switching device just described is initially explained by means of the function of an operating device.

In the rest position depicted in Fig. 1 of an operating device $3a_1$, the one switching component $8a_1'$ is situated in the region of influence of the permanent magnetic component $7a_1$ present on the operating device $3a_1$ and therefore exhibits its conducting state, whereas the other switching component $8a_1''$, removed from the permanent magnetic component $7a_1$, is situated in its blocked state. These two switching states of the two switching components are retained via a first adjustment region of the operating device, dependent on the design and arrangement of the permanent magnetic component and its connection to the one switching component.

During additional movement from the first adjustment region of the operating device, the one switching component $8a_1'$ switches to its blocked state, whereas the other switching component $8a_1''$ retains its blocked state.

These switching states of the two switching components are retained via a second (middle) region, defined by the spacing of the two switching components from each other. On leaving the middle region and entering the third region, the other switching component switches to its conducting state, whereas the one switching component retains its blocked switching state. These states of the two switching components are retained up to the end stop of the operating device on the chamber bottom and, during return of the operating device to its rest position, appropriate state changes of the switching functions allocated to the two switching components occur.

If the second operating device, with respect to its permanent magnetic components, is designed in this way and the switching components are arranged in this way and therefore connected accordingly, by different control by the cooperating cam-like control device, a corresponding dependent control can be implemented. Even greater degrees of freedom are then achieved, if the switching components are connected differently to the operating devices, or if more than two switching components or permanent magnetic components, lying one behind the other, are allocated to each operating device.

Claims

1. Electrical switching device with a multipart housing and with a plunger-like operating device, having a permanent magnetic component arranged movable in the direction of its longitudinal axis in a first housing chamber, which cooperates with a switching component that can be influenced by the permanent magnetic component present in a second housing chamber, hermetically separated from the first housing chamber by a partition, in which the permanent magnetic component, with its action element, is allocated to one side of the partition and the switching component, with its reaction element, is allocated to the other side of the partition,

characterized by the fact that the permanent magnetic component ($7a_1$, $7a_2$) is arranged on a longitudinal side ($3a_1$*, $3a_2$*) of the operating device ($3a_1$, $3a_2$) and extends, with its action element, at a limited spacing from one side ($1c_1$', $1c_2$') of the partition ($1c_1$, $1c_2$) in the movement direction of the operating device, and that, in addition to the one switching component ($8a_1$', $8a_2$') situated on the other side ($1c_1$", $1c_2$") of the partition, at least one additional switching component ($8a_1$", $8a_2$") arranged in the other housing chamber (2b) is present, which is situated in front of or behind the one switching component in the movement direction of the operating device.

2. Electrical switching device according to Claim 1, characterized by the fact that, in addition to the one operating device ($3a_1$), provided with at least one permanent magnetic component ($7a_1$) in the one housing chamber ($2a_1$), at least one additional operating device ($3a_2$) arranged parallel to the first operating device provided with at least one permanent magnetic component ($7a_2$) is present, and that, in addition to the at least two switching components ($8a_1$', $8a_1$") per additional operating device provided in the other housing chamber (2b), at least two additional, correspondingly arranged switching components ($8a_2$', $8a_2$") are present.

3. Electrical switching device according to Claim 1, characterized by the fact that each operating device ($3a_1$, $3a_2$) and/or each switching component group ($8a_1$', $8a_1$" and $8a_2$', $8a_2$") is arranged in its own housing chamber.

4. Electrical switching device according to Claim 2, characterized by the fact that the operating devices ($3a_1$, $3a_2$) and/or switching components ($8a_1$', $8a_1$", $8a_2$', $8a_2$") are each arranged in a common housing chamber (2a, 2b).

5. Electrical switching device according to one of the Claims 1 to 4, characterized by the fact that the switching components ($8a_1$', $8a_1$", $8a_2$', $8a_2$") are arranged on an electrical circuit board (9) that is held in guide grooves ($1e_1$, $1e_2$) running parallel to partition ($1c_1$, $1c_2$) provided in the housing wall sections ($1d_1$, $1d_2$)

6. Electrical switching device according to Claim 5, characterized by the fact that the conductor tracks of the circuit board (9) are connected to contact parts (10) guided out of the housing (1).

7. Electrical switching device according to Claim 6, characterized by the fact that the ends (10") of the contact parts (10) guided out of the housing (1) are formed as plug contact elements and are enclosed by a housing collar (1f).

8. Electrical switching device according to one of the Claims 1 to 7, characterized by the fact that the housing (1) consists essentially of a housing top (1a) and a housing bottom (1b), that the one housing chamber ($2a_1$, $2a_2$) is present in the housing top, and that the other housing chamber (2b) is formed by joining the housing top and housing bottom.

9. Electrical switching device according to Claim 8, characterized by the fact that the housing top (1a) and the housing top bottom (1b) are provided with hollow, cylindrical end regions cooperating with each other that are arranged relative to each other via a continuous annular sealing device (11).

10. Electrical switching device according to one of the Claims 7 to 9, characterized by the fact that the housing wall sections ($1d_1$, $1d_2$), having the guide grooves ($1e_1$, $1e_2$), are provided on the housing top (1a).

11. Electrical switching device according to one of the Claims 8 to 10, characterized by the fact that the one housing chamber ($2a_1$, $2a_2$) present in the housing top (1a) extends to the free ends of the chamber, that the operating device ($3a_1$, $3a_2$) in the one housing chamber, with its one end region ($3a_1$", $3a_2$"), is secured under the influence of a spring element ($4a_1$, $4a_2$) and, with its other (free) end region, protrudes from the housing chamber, and that the operating device is secured against falling out from the housing chamber by a mounting element (6) that partially closes the housing chamber.

12. Electrical switching device according to one of the Claims 1 to 11, characterized by the fact that the switching components are formed as switching elements that utilize the Hall effect.

Fig. 1

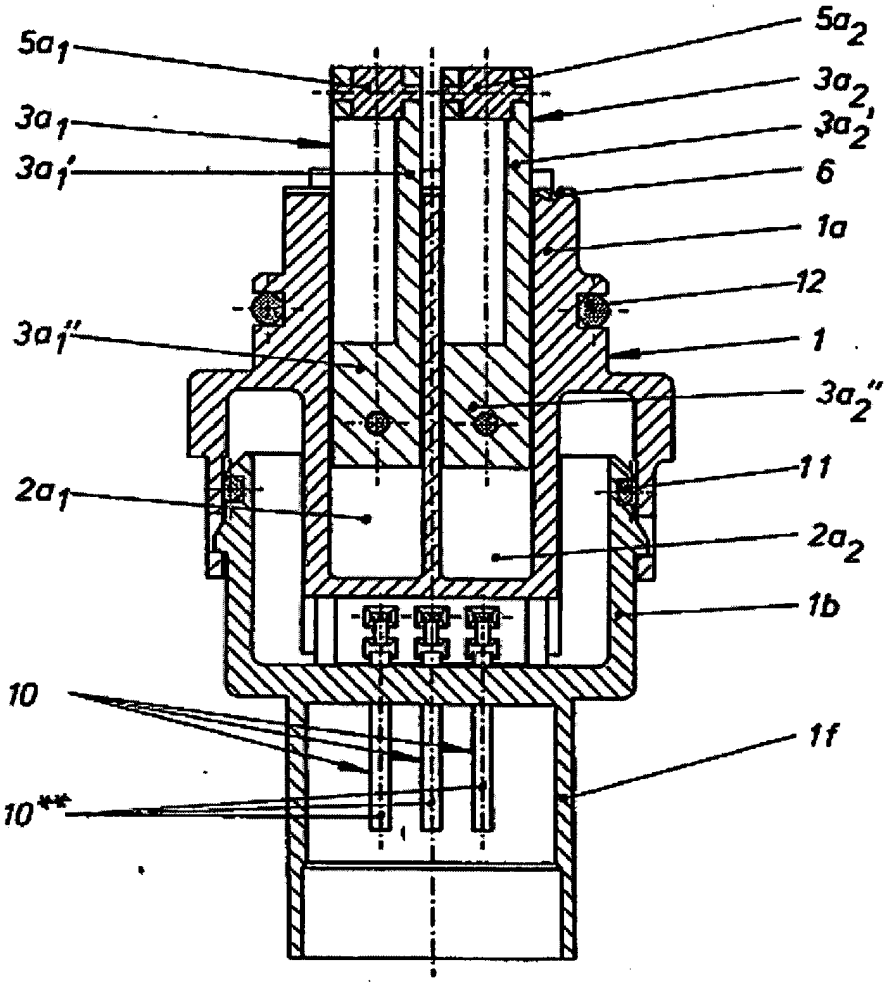
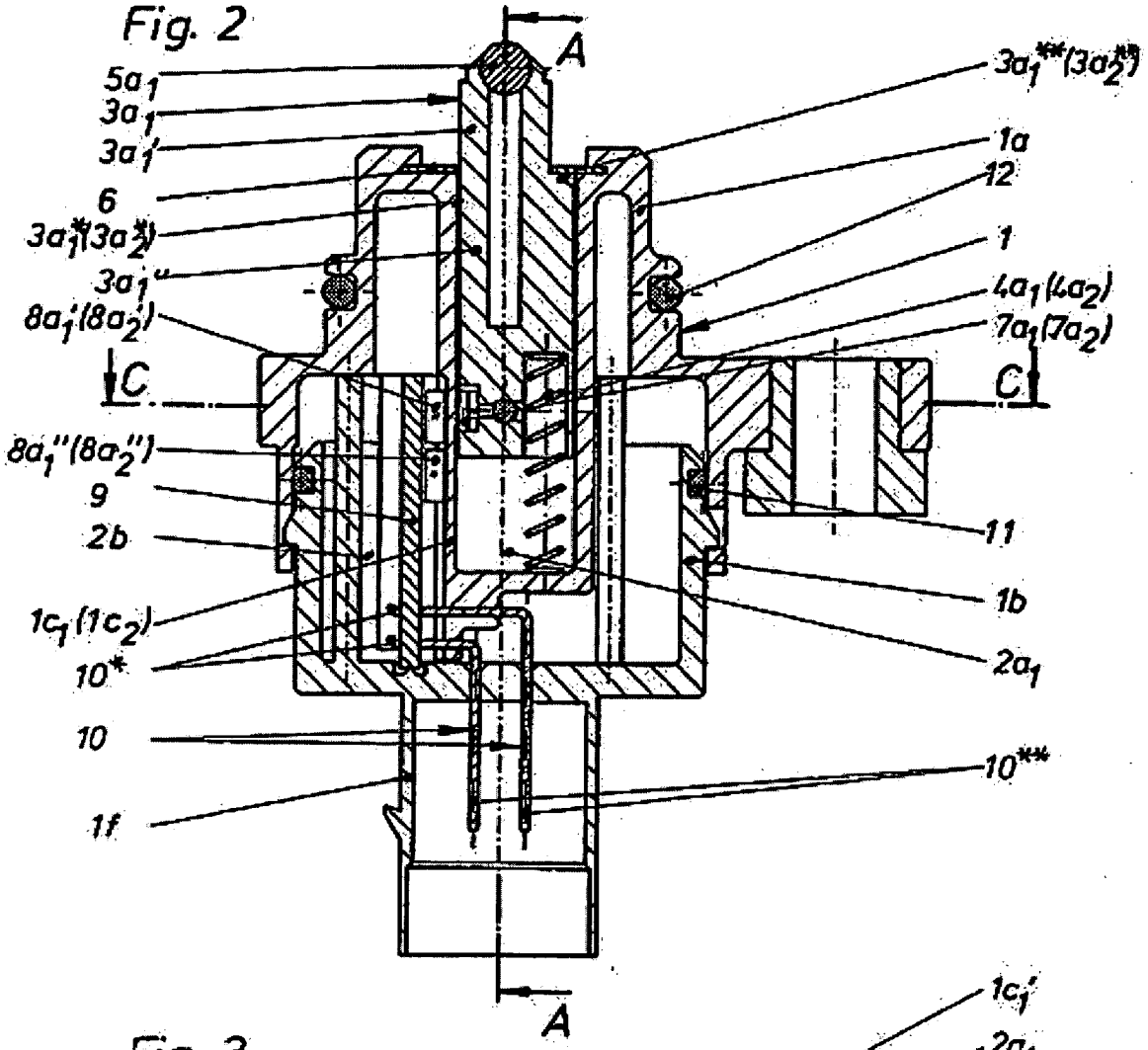


Fig. 2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3a1'
6
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3a1''
8a1'(8a2')
C
8a1''(8a2'')
9
2b
1c1(1c2)
10*
10
1f
3a1**(3a2**)
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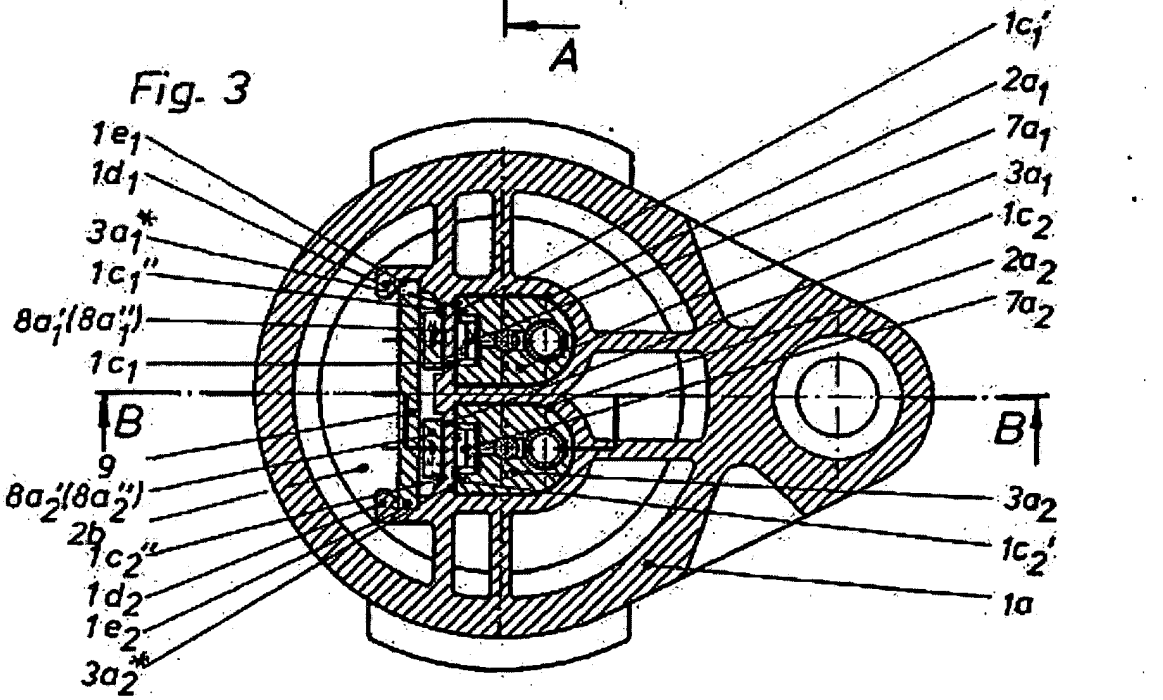
1
4a1(4a2)
7a1(7a2)
C
11
1b
2a1
10**
A

Fig. 3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